

# ***Kimbrough Sedation/Analgesia Provider Course***

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MEDDAC Regulation 40-17, subject: Conscious Sedation

**Welcome**  
**to the**  
***Kimbrough Sedation/Analgesia Provider Course***

**What?**

The Sedation/Analgesia Provider Course is a self-taught course in the preparation, procedures, and documentation involved in sedation/analgesia.

**Why?**

JCAHO has highly recommended that providers be credentialed in sedation/analgesia just as providers are credentialed for the other procedures they do. The Credentials Committee of Kimbrough has mandated that due to the changing practice and standards required for sedation/analgesia by accrediting bodies, all providers wishing to practice sedation/analgesia must be credentialed to do so. Successful completion of the Sedation/Analgesia Course is required prior to requesting privileges.

**Why Self-study?**

Since providers transfer to the Walter Reed Health Care System at all times of the year and because schedules are hard to coordinate, the self-study program allows providers to complete the course at a time convenient to them. This also alleviates the problem of limiting the provider's practice while awaiting a class-based course to be held.

**How?**

First, read and study the following material. Second, print a test and answer sheet. After completing the test, return the answer sheet to the following address:

CDR USAMEDDAC  
ATTN MCXR DN ANE LTC ALBEE  
2480 LLEWELLYN AVE  
FORT MEADE MD 20755-5800

The test is intended to be a closed-book exam. A passing grade is 80%. If you do not pass, re-study the material and then re-take the test. This course is in a semi-outline form to make it more readable and to allow for easier future reference of the material.

**When?**

The course may be taken at any time and must be passed prior to providing sedation/analgesia at Kimbrough Ambulatory Care Center.

## Section 1

# Pre-Sedation/Analgesia Workup

## I. Overview:

- A. Definitions and goals
- B. Pre-procedure assessment (history and physical)
- C. Laboratory tests
- D. NPO guidelines

## II. Definitions and Goals

### A. Definitions

1. **Sedation and Analgesia:** “...Describes a state that allows patients to tolerate unpleasant procedures while maintaining adequate cardiorespiratory function and the ability to respond purposefully to verbal command and/or tactile stimulation.” (Practice Guidelines...Anesthesiology, 1996:459) The drugs for sedation/analgesia may be given PO, PR, IV, IM, IN, or by inhalation.

2. **Old term:** Conscious Sedation. This term was replaced due to the fact that it is an oxymoron since sedated patients often have altered mental status.

**Question:** If I give a *PO* sedative for a procedure, do I have to follow the entire workup, monitoring, and recovery requirements as for IV sedation?

**Answer:** The MEDDAC Reg. 40-17 allows for a one-time *PO* sedative:

*An adult patient receiving strictly a one-time, pre-diagnostic **PO sedative** will be exempt from the documentation and monitoring of this policy if, in the judgement of the prescribing physician, the dosage and drug given **would not result in impairment of protective or airway reflexes**. The provider assumes responsibility of ensuring the patient is accompanied by an escort, instructions are given regarding when the patient may resume normal activities, and counseling regarding possible side effects is given. This exception does not apply to children. It also does not apply if any additional *PO, IM or IV* sedative/analgesics are given.*

In other words, it would be acceptable to give a 30 year-old healthy female who is claustrophobic a *PO* dose of valium prior to an MRI. It would likely not be acceptable to give a 75 year-old male with severe COPD and CAD any sedative without monitoring.

3. There are **4 components** to sedation/analgesia.

**Amnesia**- Forget what happens

**Anxiolysis**- Relieves anxiety

**Hypnosis**- Decreased level of consciousness (“sleepy”)

**Analgesia**- Pain relief

Keep these in mind when choosing the **type** of drug and the **purpose** for which it is being given. For example, benzodiazepines are poor analgesics but excellent amnestics, anxiolytics, and hypnotics. Narcotics, on the other hand are excellent analgesics but are poor amnestics.

## **B. Goals**

Your goals are to ensure:

1. The patient is responsive and cooperative.
2. Spontaneous ventilation is maintained.
3. Airway reflexes are maintained (to prevent aspiration).
4. Autonomic reflexes are maintained.

## **C. Levels of Sedation/Analgesia**

Depth of sedation/analgesia is based on response to **stimulus**, presence of protective **airway reflexes**, and **patency** of the airway.

1. **Light:** All present
2. **Deep:** Response only to vigorous stimuli; may intermittently lose protective reflexes; intermittent airway obstruction.
3. **General Anesthesia:** No response to stimuli. Protective reflexes absent.

**\*\* Since the levels represent a continuum, BE PREPARED if the patient becomes deeper than you anticipate.**

## **III. Pre-Procedure Patient Assessment**

### **A. General Principles**

1. Is the condition stable?
2. Is the patient optimized (*e.g.*: on medication, URI resolved)?

3. Will waiting improve the patient's risk (for elective procedures)?
4. Will waiting increase the patient's risk (therefore, a non-elective procedure)?

## **B. General Assessment**

1. Age, weight, height, sex
2. Allergies to medications
3. Medications being taken
4. Past surgical/anesthesia history--**Response to prior medications.** This is very important because "if it happened before, it will likely happen again." If the patient became hyperactive with chloral hydrate in the past, don't use it. If a patient reports being very sensitive to sedative/analgesics in the past, titrate even more slowly than usual.
5. Social--tobacco, alcohol, recreational drug use.

## **C. Airway Assessment**

**In addition to heart and lung exams, the sedation/analgesia policy requires documentation of a brief airway exam.**

1. Assess whether the patient can open mouth widely and tilt head back. Assess the chin length (thyro-mental distance).
2. The Mallampati classification--based on what can be seen when patient opens mouth. Optional for non-anesthesia providers.
3. Watch out for history of heroic snoring, sleep apnea, or presence of cervical abnormalities, obesity, laryngeal or neck masses. These patients may obstruct easily when sedated and may be very difficult to mask ventilate or intubate.

An example of an airway exam might be: *Wide opening, large tongue, small chin, good neck extension.*

**4. Difficult Airway. If the patient appears to have a difficult airway (cannot open mouth, small chin, large tongue, or poor neck extension):**

- a. Reassess the need for sedation.
- b. Sedate lightly if required.
- c. If unable to do with *light* sedation, schedule anesthesia assistance.

## **D. Neurologic Assessment**

1. History of seizures--Stable on meds?
2. Trauma/tumors--Ensure no increased ICP. If so, sedation may cause hypoventilation, increased  $\text{paCO}_2$ , increased cerebral blood flow, and further increase ICP.
3. Muscle/nerve disorders--Watch out for respiratory failure or inability to maintain airway reflexes or patency (*e.g.*: myasthenia).

## **E. Cardiovascular Assessment**

1. CAD/CHF/MI/Valvular Disease--ensure no recent events, on meds, stable, good exercise tolerance.
2. Hypertension--controlled.

**Question:** My patient had a BP of 160/100 this morning when he came in for colonoscopy. He took his BP meds this morning. Does he need to be canceled?

**Answer:** The anesthesia literature regarding hypertension shows that patients with a diastolic of less than 105 mmHg FOR NON-NEUROLOGIC PROCEDURES do not have a worse outcome than normotensives. Obviously, you may wish to cancel based on the procedure (*e.g.*: patient having angiography and you are worried about insertion site bleeding, *etc.*). Also, this assumes the patient has no symptoms of a hypertensive emergency. The blood pressure also may be elevated due to anxiety, so a look in the patient's records to assess usual pressures would be helpful. Obviously, use common sense.

3. Arrhythmias--controlled. Determine rhythm pre-sedation and monitor EKG.
4. Ensure medications taken prior to procedure!
5. Do not proceed if patient is not optimized.

## **F. Pulmonary Assessment**

1. Smoking history/COPD/asthma--ensure optimized and meds taken. Listen to lungs immediately pre-sedation.
2. Recent URI--wait 2 weeks after symptom resolution if possible.
3. Recent pneumonia--wait 4 weeks after resolution if possible.
4. Obtain baseline oxygen saturation prior to sedation.

5. Do not sedate if significant respiratory compromise. If the baseline oxygen saturation is low, it will only get worse with sedation/analgesia.

## **G. Gastrointestinal Assessment**

1. Gastro-esophageal reflux (GER) is a concern due to the increased risk of aspiration with sedation/analgesia.
2. Risk factors for gastro-esophageal reflux include:
  - hiatal hernia
  - obesity
  - pregnancy
  - neurologic dysfunction (cerebral palsy, diabetes)
  - narcotic pain medications
  - trauma
  - full stomach
3. If the patient has symptoms or risk factors for GER, make sure the patient is *NPO*, has taken his/her anti-reflux/H2 blocker meds, and do not over-sedate.

## **H. Hepatic-Renal Assessment**

1. Hepatic failure patients may be more sensitive **or** demonstrate increased resistance to sedative medications. Renal failure or dialysis dependent patients will demonstrate an increased sensitivity to these medications due to a decrease in protein binding, increased plasma levels of the medications, and drug accumulation. Emphasis here is on **careful titration and intense assessment**.
2. Watch out for fluid status. Limit the amount of fluid and avoid potassium-containing fluids for renal failure patients.
3. Check whether the patient has had electrolyte abnormalities.

## **I. Endocrine Assessment**

1. Diabetes
  - a. Principle: Blood sugar is better high than low during sedation/analgesia.
  - b. If not brittle (keto acidosis-prone) diabetic, hold or reduce insulin/hypoglycemic drugs pre-procedure.
  - c. Do first case or early in the day.
  - d. Watch out for co-existing problems:
    - 1.) CAD
    - 2.) GER
    - 3.) Kidney disease

- e. Check finger-stick glucose pre-procedure and at appropriate intervals.
- f. Ensure tolerating *PO* prior to discharge.

## 2. Thyroid Disease

- a. The goal is to have the patient euthyroid.
- b. Look for symptoms of obvious hyper- or hypothyroidism (extremes of pulse, changes in weight or general energy).
- c. Avoid sedating if signs/symptoms of profound hyper- or hypothyroidism exist.

## **J. Hematologic Assessment**

- 1. Anemia--check HGB if indicated (*e.g.*: pt. with rectal bleeding).
- 2. Bleeding disorders--easy bleeding/bruising
  - a. Examine patient.
  - b. Ask if history of bleeding disorders.

## **K. Obesity**

Obese patients are at increased risk with sedation/analgesia for several reasons:

- 1. Airway risk
  - a. Easily obstruct
  - b. Can be difficult to intubate
- 2. Increased risk of gastro-esophageal reflux.
- 3. Pulmonary/cardiac history. Ask if concurrent lung/heart problems exist.

## **L. OB/GYN Assessment**

- 1. Take history to ensure patient not pregnant.
- 2. If patient pregnant and MUST proceed, consult anesthesia and obstetrics first and ensure medications used are not teratogenic.

## **M. ASA Criteria**

The American Society of Anesthesiologists has developed a risk assessment scale. **JCAHO requires providers document a risk assessment in the pre-procedure note and state whether the patient is an acceptable candidate for sedation/analgesia.**

1. The risk classification must be assigned by the provider prior to the procedure.
2. **ASA I or II patients are candidates for sedation/analgesia by non-anesthesia providers. If ASA category greater than II, the patient *may* need enhanced monitored anesthesia care.**

For example, patients undergoing cardiac cath are often ASA III or greater. However, they are carefully monitored in the cath lab by providers skilled in caring for cardiac patients.

In contrast, a morbidly obese patient ASA III because of sleep apnea and pulmonary hypertension having a CT-guided biopsy may require enhanced anesthesia care by anesthesia personnel. In this case, if the radiologist is not skilled in airway management and in caring for these types of patients, he/she may want to schedule the case with anesthesia assistance.

This caveat may also not apply to ICU ventilator patients. In this case, the patient is already intubated and is accompanied by a physician or ICU nurse.

### 3. ASA physical status

- a. **ASA class I:** healthy
- b. **ASA class II:** mild to moderate systemic disturbance, well-controlled (eg: well-controlled hypertension, asymptomatic CAD on meds).
- c. **ASA class III:** severe systemic disturbance that limits normal activities (eg: poorly controlled hypertension, angina that limits activity).
- d. **ASA class IV:** severe, life-threatening disturbance (e.g.: angina at rest).
- e. **ASA class V:** Moribund patient with little chance of survival.

An example then of a pre-procedure assessment would be:

*70 year old male ASA II for hypertension and adult onset diabetes for colonoscopy with sedation/analgesia. Pt. is an acceptable candidate for sedation/analgesia.*

### 4. Change in physical status

- a. Often, the history and physical are done days to weeks prior to the procedure.
- b. **Immediately prior** to the sedation/analgesia, the patient should be questioned if there has been a change in their health since the initial evaluation.
- c. Document in the record that there has been **no change in physical status (JCAHO REQUIREMENT)**.

## N. Pre-procedure section summary

1. Examine the airway prior to sedation and document on the history and physical.

2. Ensure systemic diseases are well controlled and stable.
3. Ensure pt. has been assigned an ASA classification and state the patient is an acceptable candidate for sedation/analgesia (**JCAHO REQUIREMENT**).
4. Immediately prior to sedation/analgesia, state in the record that there has been no change in physical status (**JCAHO REQUIREMENT**).

#### **IV. Pre-Procedure Laboratory Tests**

A. There is no *mandatory* testing for patients receiving sedation/analgesia by non-anesthesia providers outside of the O.R.

B. The following are required if a CRNA or anesthesiologist performs the sedation/analgesia and recommended for all:

1. **Children:** none
2. **Under 40:** pregnancy test and hgb/hct for females
3. **Age 40-59:** EKG. If female, plus hgb/hct (unless s/p hysterectomy). Pregnancy test as applicable.
4. **Over 60:** EKG, CXR, hgb/hct, BUN, glucose.
5. Additional tests as indicated by patient's condition.

#### **V. NPO Guidelines**

A. **Adults:** NPO after midnight

B. **Children** (12 years and younger):

1. No solids after midnight.
2. Clear liquids (ONLY apple juice, water, or Pedialyte) until 2 hours pre-procedure.

#### **VI. Section One Summary**

**A. Definitions and goals of sedation/analgesia:**

**\*\*Keep them responsive and cooperative.**

**B. Pre-procedure assessment:**

\*\*Document airway exam, ASA status and suitability for sedation/analgesia.

\*\*Document no change in physical status immediately prior to sedation/analgesia.

\*\*Ensure conditions are well controlled and stable.

**C. Laboratory tests:**

\*\*Recommended--none required.

**D. NPO guidelines:**

\*\*NPO after midnight for adults.

\*\*Clear liquids until 2 hours before for children (No solids after midnight).

## Section 2

# Sedation/Analgesia Medications

### I. Overview:

- A. General guidelines for titration of sedative/analgesics
- B. The Benzodiazepines
- C. The Narcotics
- D. Ketamine

### II. General Guidelines for Titration of Sedative/Analgesics

Prior to considering the drugs themselves, we will begin with some practical points on administration of sedation/analgesia.

#### A. Desired endpoints of optimal sedation and analgesia:

1. Calm, comfortable patient
2. Slightly sleepy
3. Slurred speech
4. Regular respirations, no less than 10/min (adult)

#### B. Undesirable effects of sedation/analgesia:

1. Agitation
2. Disorientation
3. Confusion
4. Hypoxia, respiratory depression, resp rate < 10/min, apnea.
5. Depressed level of consciousness (deep sleep or unable to arouse).
6. Loss of protective reflexes.
7. Hypotension or severe hypertension < or > 30% of baseline.
8. Severe bradycardia, tachycardia, or arrhythmias.

#### C. Practical guidelines on administration of sedation/analgesia

To obtain the desired endpoint without the undesirable side effects, consider the following:

1. *Slow* titration (*e.g.*: 1/2 of the recommended dose; wait; 1/4 of the remaining dose; wait and reassess; last remaining 1/4 dose and reassess.)
2. Patient response dictates dosage (*i.e.*: level of consciousness, respiratory rate, vital signs, *etc.*).

3. Use the appropriate drug for the procedure (*i.e.*: analgesics for painful procedures and sedative/hypnotics for non-painful procedures).
4. Dosage requirements will vary based on:
  - a. height/weight/age
  - b. renal, liver failure
  - c. ETOH and drug use
  - d. body habitus
5. Decrease the dose when combining benzodiazepines and narcotics. The combination will have a **synergistic** effect on ventilatory depression.
6. Decrease the dose for the elderly and debilitated patients.
7. **Caution:** At the completion of a painful procedure, the stimulus is gone but the sedation/analgesia remains. Observe for respiratory depression.

### III. Benzodiazepines

#### A. Mechanism of Action:

GABA (gamma-amino-butyric acid) is an inhibitory neurotransmitter in the central nervous system. Benzodiazepines enhance the function of GABA by facilitating the binding of this neurotransmitter to its receptor. This causes hyperpolarization of cell membranes making them more resistant to neuronal excitation.

#### B. Pharmacologic Properties:

1. Anxiolytic
2. Hypnotic
3. Anticonvulsant
4. Skeletal muscle relaxant
5. Amnestic

#### C. Indications:

1. Provide sedation
2. Provide amnesia
3. **No analgesic effects**

#### D. The Two Common Benzodiazepines:

##### 1. DIAZEPAM (VALIUM)

**CLASS:** Benzodiazepine: sedative, hypnotic, amnestic, skeletal muscle relaxant, anticonvulsant

**DOSAGE:**

For sedation:

1. adults: 0.02-0.15 mg/kg – IV, IM, PO, rectal
2. usually 2-10 mg
3. give in 1-2 mg increments IV

**ONSET:**

IV: < 2 min  
Rectal: < 10 min  
PO: 15 min – 1 hr

**PEAK:**

IV: 3 – 4 min

**DURATION:**

IV: ~4 hrs  
PO: 4 – 6 hrs

**CONTRAINDICATIONS:**

1. Known hypersensitivity.
2. Untreated acute narrow angle or untreated open angle glaucoma.
3. Pregnancy.
4. Shock, coma, respiratory depression

**SIDE EFFECTS:**

**CV:** bradycardia, hypotension  
**PULM:** respiratory depression  
**CNS:** drowsiness, ataxia, confusion, depression, paradoxical excitement  
**GU:** incontinence  
**DERM:** rash  
**OTHER:** venous thrombosis, phlebitis at the site of injection, dry mouth

**2. MIDAZOLAM (VERSED)**

**CLASS:** Benzodiazepine; sedative, hypnotic, anxiolytic, anticonvulsant, skeletal muscle relaxant

**DOSAGE:**

Use only the 1 mg/cc concentration (orange vials)

1. Dose range: 0.01 – 0.15 mg/kg IV
2. Individualize dose.
3. **Give in 1 mg increments** or less over 2 min for healthy adults (elderly/debilitated: give in 0.5 mg increments).
4. Never bolus: titrate to desired effect.
5. Total dose of > 5 mg is usually not necessary.

6. Maintenance doses: additional increments of 25% of initial dose to maintain desired level.

**ONSET:**

IV: 30 sec - 1 minute

**PEAK:**

IV: 3 - 5 minutes

**DURATION:**

IV: 15-120 minutes

**CONTRAINDICATIONS:**

1. Known hypersensitivity
2. Acute narrow-angle or untreated open angle glaucoma
3. Pregnancy
4. Shock, coma, respiratory depression

**SIDE EFFECTS:**

**CV:** tachycardia, vasovagal episodes, PVC's, hypotension

**PULM:** bronchospasm, laryngospasm, apnea, hypoventilation

**CNS:** euphoria, disinhibition, tonic-clonic movements, agitation, hyperactivity

**GI:** salivation, retching, acid taste

**DERM:** rash, pruritis

**E. Guidelines/Precautions (Diazepam-Midazolam):**

1. Inject diazepam slowly (over 2 - 3 minutes) into a large vein to decrease the chance of thrombophlebitis.
2. Diazepam--return of drowsiness may occur 6 – 8 hrs after dose due to enterohepatic recirculation.
3. Diazepam IM route is painful and results in slow, erratic absorption.
4. Treat overdose with flumazenil.

## F. Comparison of Diazepam and Midazolam

### DIAZEPAM

- propylene glycol: pain on injection
- less potent
- slower onset
- long duration
- half-life of 21 - 37 hrs

### MIDAZOLAM

- water soluble: no pain on injection
- 2 - 3 x's more potent
- rapid onset
- rapid recovery
- half-life of 1-4 hours

## IV. Opioids

### A. Terms:

1. **Opium**: Greek for juice.
2. The juice of the poppy is the source of 20 distinct alkaloids of opium.
3. **Opioid**: substance that binds to any of the opioid receptors and produces some morphine-like effect.
4. **Narcotic**: derived from the Greek word for stupor; used to refer to morphine-like analgesics with the potential to produce physical dependence.

### B. Mechanism of Action:

1. Mimic the action of endorphins by binding to opioid receptors, resulting in activation of a pain-modulating system--hence, analgesia or pain relief.
2. There are 5 opioid receptors: Mu receptors (morphine-preferring) are responsible for analgesia (supraspinal). Binding to other opioid receptors causes the side effects we see from narcotics: sedation, euphoria, n/v, pruritis, respiratory depression, bradycardia, *etc.*

### C. Indications:

1. To provide **analgesia** or pain relief for invasive, diagnostic, therapeutic, or surgical procedures.
2. Does **not** provide amnesia.

## **D. The Three Common Opioids:**

### **1. MEPERIDINE (DEMEROL)**

**CLASS:** opioid agonist

**DOSAGE:**

1. Individualize dose
2. 0.10 - 1.0 mg/kg slow IV; titrate to effect
3. 50 - 150 mg (1 - 3 mg/kg) IM q 3 - 4 hrs
4. Healthy pt < 40 yrs old, usually 75 - 100 mg
5. Elderly/debilitated pts, usually 20 - 50 mg

**ONSET:**

IV: < 1 minute  
IM: 1 - 5 minutes

**PEAK:**

IV: 5 - 20 minutes  
IM: 30 - 50 minutes

**DURATION:**

IV/IM: 2 - 4 hours

**CONTRAINDICATIONS:**

1. Known hypersensitivity.
2. Respiratory depression; severe pulmonary disease, renal or hepatic failure.
3. Patients taking MAO inhibitors (often fatal: HTN, tachycardia, hyperthermia, seizures).
4. History of seizures.

**SIDE EFFECTS:**

**CV:** hypotension, cardiac arrest, tachycardia,  
**PULM:** respiratory depression, arrest, laryngospasm  
**CNS:** euphoria, dysphoria, sedation, seizures, physical dependence, dizziness  
**GI:** constipation, biliary tract spasm, n/v  
**MS:** chest wall rigidity  
**DERM:** urticaria, pruritis

**GUIDELINES/PRECAUTIONS:**

1. Use with caution in pts. with asthma, COPD, increased ICP, and SVT (vagolytic effect).
2. May see seizures, myoclonus, and delirium with repeated doses (due to active metabolite) and in pts. with renal or hepatic impairment.

## **2. MORPHINE**

**CLASS:** Opioid agonist

**DOSAGE:**

1. IV: 0.01 - 0.1 mg/kg (max 15 mg)
2. Titrate slowly in 1 - 2 mg increments over 2 - 3 minutes
3. IM: 2.5 - 15 mg

**ONSET:**

IV: < 1 minute  
IM: 1 - 5 minutes

**PEAK:**

IV: 5 - 20 minutes  
IM: 30 - 60 minutes

**DURATION:**

IV/IM: 4 - 5 hours

**CONTRAINDICATIONS:**

1. Known hypersensitivity.
2. Caution in asthmatics.
3. Respiratory depression.

**SIDE EFFECTS:**

**CV:** hypotension, tachycardia, bradycardia, arrhythmias  
**MS:** chest wall rigidity  
**PULM:** bronchospasm, laryngospasm, respiratory depression  
**CNS:** blurred vision, syncope, euphoria  
**GU:** urinary retention  
**GI:** biliary tract spasm  
**EYE:** miosis  
**DERM:** urticaria, pruritis

**GUIDELINES/PRECAUTIONS:**

1. Ten times more potent than demerol.
2. Releases histamine.
3. Produces decrease in peripheral vascular resistance.
4. CNS and circulatory depressant effects are potentiated by ETOH, sedatives, narcotics, antihistamines, phenothiazines, butyrophenones, and tricyclic antidepressants.

### 3. FENTANYL (SUBLIMAZE)

**CLASS:** Opioid agonist

**DOSAGE:**

1. IV: 0.5 - 3 mcg/kg
2. Supplied in **MICROGRAMS**: 50 mcg/ml
3. **Give in 25 - 50 mcg increments** (0.5 - 1 ml)
4. Titrate slowly

**ONSET:**

IV: within 30 seconds

**PEAK:**

IV: 5 - 15 minutes

**DURATION:**

IV: 30 - 60 minutes

**CONTRAINDICATIONS:**

Respiratory depression

**SIDE EFFECTS:**

**CV:** hypotension, bradycardia  
**PULM:** respiratory depression, apnea  
**CNS:** dizziness, blurred vision  
**GI:** n/v, delayed gastric emptying, biliary tract spasm  
**EYE:** miosis  
**MS:** chest wall rigidity

**GUIDELINES/PRECAUTIONS:**

1. 100 x's more potent than morphine.
2. Rapid onset with a relatively short duration.
3. Greater respiratory depression than demerol or morphine.
4. Greater incidence of chest wall rigidity.

### E. Guidelines/Precautions for Opioids

1. When administering for sedation/analgesia, continuously observe and monitor the patient.
2. Have resuscitative equipment available.

3. May see chest wall rigidity and inability to ventilate (narcan will reverse; neuromuscular blockers will reverse the rigidity but will need to intubate and sedate).
4. Reversal is narcan; duration of reversal may be shorter than the duration of the narcotic.
5. Decrease the dosage in the elderly, debilitated, hypovolemic, and high risk patients.
6. Decrease the dosage when using concomitant sedatives/narcotics.

## **F. Comparisons: Opioids**

### **1. Potency:**

- a. Morphine: Gold standard to which others are compared.
- b. Demerol: is **1/10<sup>th</sup>** the potency of morphine.
- c. Fentanyl: is **100 times more potent** than morphine.

### **2. Duration:**

- a. Morphine: 4 - 5 hours
- b. Demerol: 2 - 4 hours
- c. Fentanyl: 30 min - 1 hour

### **3. Caution:**

- a. Morphine: histamine release
- b. Demerol: tachycardia, MAO inhibitors
- c. Fentanyl: greater incidence of chest wall rigidity

## **V. Ketamine (KETALAR)**

**CLASS:** Dissociative anesthetic; phencyclidine (PCP) derivative

### **MECHANISM OF ACTION:**

1. Causes dissociation between the thalamocortical and limbic systems. Dissociative anesthesia resembles a cataleptic state: eyes are open with a nystagmic gaze. The patient is not communicating although he appears awake. Hypertonus and skeletal muscle movements are often present!
2. Causes **intense analgesia and amnesia**.

**DOSE:** IV: 0.25 - 1 mg/kg  
IM: 2.5 - 5 mg/kg

**ONSET:**

IV: < 30 seconds  
IM: 3 - 4 minutes

**PEAK:**

IV: 1 minute  
IM: 5 - 20 minutes

**DURATION:**

IV: 5 - 15 minutes  
IM: 12 - 25 minutes

**CONTRAINDICATIONS:**

1. Increased ICP
2. Severe, uncontrolled hypertension, tachycardia, or ischemic heart disease.
3. Acute cocaine intoxication.
4. Avoid in preterm infants: may cause prolonged apnea and bradycardia.

**SIDE EFFECTS:**

**CV:** hypertension, tachycardia, arrhythmias, bradycardia  
**PULM:** respiratory depression, apnea, laryngospasm  
**CNS:** tonic-clonic movements, emergence delirium  
**GI:** hypersalivation, n/v  
**EYE:** nystagmus, diplopia, increased intraocular tension

**GUIDELINES/PRECAUTIONS:**

1. Caution with concomitant use of sympathomimetics (epinephrine): causes HTN, tachycardia, myocardial ischemia.
2. Critically ill patients with catecholamine depletion may respond with an unexpected reduction in blood pressure and cardiac output.
3. Expect emergence delirium (dreaming, hallucinations, confusion, agitation). Recover pt. in a quiet, private, dark area (most common in ages 15 - 65 yrs).
4. Side effects may be less if also given a benzodiazepine.
5. Causes salivation: antisialagogue recommended (*eg:* robinul).

**VI. Section Two Summary**

- A. Goal:** obtain a cooperative, sedated, comfortable patient.
- B.** Titrate drugs slowly to achieve this endpoint without over-sedating.
- C.** Know the pharmacologic properties of the benzodiazepines, narcotics, and ketamine.
- D.** Match the appropriate drug to the desired goal (*e.g.:* amnesia, hypnosis, analgesia, *etc.*).

### *Section 3*

## **Reversal Agents: Naloxone and Flumazenil**

### **I. Overview:**

In this section, we will review the narcotic and benzodiazepine reversal agents.

- A. Naloxone
- B. Flumazenil

### **II. NALOXONE (NARCAN)**

**CLASS:** Opioid antagonist

**MECHANISM OF ACTION:**

1. Competitively inhibits opioid agonists at receptor sites and prevents the effects of opioids, including respiratory depression, sedation, hypotension, analgesia, and biliary tract spasm.
2. Narcan produces withdrawal symptoms in the presence of physical dependence.

**DOSAGE:**

1. Individualize
2. Supplied as 0.4 mg/ml: \*\* DILUTE 1 ml (0.4 mg or 400 micrograms) with 9 ml of normal saline to equal a final concentration of 40 mcg/ml.
3. Slowly titrate 1 ml of diluted solution at a time (40 mcg increments) to desired patient response.

**ONSET:**

IV: 1 - 2 minutes

**PEAK:**

IV: 5 - 15 minutes

**DURATION:**

IV: 1 - 4 hours

**CONTRAINDICATIONS:**

1. Hypersensitivity
2. Opioid dependence

**SIDE EFFECTS:**

**CV:** tachycardia, hypertension, hypotension, arrhythmias

**PULM:** pulmonary edema  
**CNS:** tremulousness, reversal of analgesia, sedation  
**GI:** nausea/vomiting  
**Other:** sweating

**GUIDELINES/PRECAUTIONS:**

1. Use with caution in preexisting cardiac disease or in those who have received cardiotoxic drugs.
2. Titrate slowly to desired effect. Excessive dosage may result in reversal of analgesia and cause other side effects: hypertension, excitement, pulmonary edema, arrhythmias.
3. **Monitor patients at least two hours after narcan**--duration of action of some opioids may exceed that of narcan. Patients may require **repeat doses** of narcan.

### **III. FLUMAZENIL (ROMAZICON)**

**CLASS:** Benzodiazepine antagonist

**MECHANISM OF ACTION:**

1. Competitively inhibits the activity at the benzodiazepine receptor site on the GABA/BZ receptor complex in the central nervous system.
2. Reverses sedation, respiratory depression, amnesia, and psychomotor effects of benzodiazepines.

**DOSAGE:**

1. IV: 0.2 - 1 mg at a rate of 0.2 mg/min
2. Titrate to effect
3. May repeat at 20 minute intervals
4. Maximum single dose: 1 mg
5. Maximum total dose: 3 mg in any 1 hour

**ONSET:**

IV: 1 - 2 minutes

**PEAK:**

IV: 2 - 10 minutes

**DURATION:**

IV: 45 - 90 minutes

**CONTRAINDICATIONS:**

1. Known hypersensitivity
2. Tricyclic antidepressant poisoning
3. Caution: may provoke panic attacks in patients with a history of panic disorder.
4. Patients treated with BZ's to control life-threatening conditions--e.g: status epilepticus.
5. Patients on long-term BZ therapy (seizures).

#### GUIDELINES/PRECAUTIONS:

1. Titrate dose slowly. Be prepared to treat seizures.
2. **After flumazenil, monitor the patient for a minimum of two hours for resedation, respiratory depression.** The duration of flumazenil may be shorter than the BZ duration.
3. Produces withdrawal symptoms (seizures, emergence confusion, and agitation) in the presence of physical dependence.

#### IV. Section Three Summary

- A. Naloxone is the narcotic reversal agent and **should be diluted** prior to administration.
- B. Flumazenil is the benzodiazepine reversal agent and does **not** need to be diluted prior to administration.
- C. In most cases, reversal can be **titrated** to effect.
- D. Patients must be monitored for **2 hours** after reversal is given.

## *Section 4*

# **Inappropriate Agents for Sedation /Analgesia Outside of the Operating Room**

## **I. Overview**

The following agents are inappropriate for sedation/analgesia by non-anesthesia providers outside of the OR. Some detail has been provided for your interest, but the important thing is to know that these should **not** be used.

### **A. Barbiturates:**

1. May cause **apnea** even at low doses; hypotension.
2. Lowers pain threshold in low doses (**antianalgesic**).
3. Can cause paradoxical excitement.
4. Short duration of effect caused by redistribution rather than metabolism. Drug may accumulate in tissues following repeated doses; therefore, sedation is brief while residual CNS effects persist for many hours (long half-life).
5. Lower therapeutic index and higher risk for drug interactions than with benzodiazepines.
6. Half lives:
  - a. Long-acting: phenobarbital. Half-life: 24-96 hrs
  - b. Medium-acting: pentobarbital. Half-life: 21-42 hrs
  - c. Short-acting: secobarbital. Half-life: 20-28 hrs
  - d. Ultra-short: thiopental. Half-life: 10-12 hrs
7. Pentobarbital may and has been used in **pediatric** sedation/analgesia for radiologic procedures. It should not be used for painful procedures since it possesses antianalgesic properties.

### **B. Propofol (Diprivan):**

1. IV hypnotic agent
2. May cause **apnea and hypotension** even at low doses, making the drug difficult to titrate for sedation.
3. Causes pain on injection.

4. Does not have any analgesic effect, but unlike barbiturates, it is not antianalgesic.

5. May be used for sedation of ventilated patients in the intensive care unit.

**C. Sufentanil (Sufenta):**

1. Thiamyl analogue of fentanyl; 5 - 10 times more potent than fentanyl (500-1,000 times more potent than morphine). Inappropriate for sedation/analgesia settings outside of the operating room.

2. **Profound respiratory depression** even at low doses.

3. Profound bradycardia even at low doses.

**D. Alfentanil (Alfenta):**

1. Potent opioid analgesic with rapid onset and short duration of action.

2. Associated with a **greater incidence of side effects** than fentanyl including: hypotension, bradycardia, chest wall rigidity, and nausea and vomiting.

**E. Nitrous Oxide:**

1. Colorless gas; potent analgesic but weak anesthetic agent.

2. Depresses airway reflexes.

3. Analgesic dose requires use of lower FIO<sub>2</sub>, reducing the margin of safety.

4. Risk of diffusion hypoxia.

**F. Neuromuscular Blocking Agents (Muscle relaxants) **nondepolarizers** (Vecuronium, Rocuronium, Pancuronium, etc):**

1. Skeletal muscle paralysis is only appropriate for a patient under general anesthesia, who is rendered amnestic, and whose airway is protected by an endotracheal tube.

2. Have **no place in sedation/analgesia settings**.

**G. Neuromuscular Blocking Agents (Muscle relaxants) **depolarizers** Succinylcholine):**

1. In the setting of sedation/analgesia, the rapid-acting neuromuscular blocking agent succinylcholine is **ONLY** to be used for emergently securing the airway (i.e. facilitating placement of an endotracheal tube).

2. Succinylcholine is **only** to be used by personnel trained in airway management.

## **II. Summary of Section IV:**

The barbiturates, propofol, sufentanil, alfentanil, nitrous oxide, and the neuromuscular blocking agents should not be use for sedation outside of the operating room by non-anesthesia providers.

## Section 5

# Monitoring in Sedation/Analgesia

This section reviews the equipment and personnel required for sedation/analgesia.

## I. The Equipment

A. The **minimum equipment** required for sedation/analgesia is based on the depth of sedation/analgesia anticipated.

- |                              |   |
|------------------------------|---|
| 1. Local anesthesia only:    | Crash cart, ambu bag, mask, oxygen, suction                                     |
| 2. Light sedation/analgesia: | The above plus pulse oximeter and BP cuff.                                      |
| 3. Heavy sedation/analgesia: | The above plus cardiac monitor.   |
| 4. General Anesthesia:       | The above plus ventilator, end-tidal CO <sub>2</sub> , and temperature monitor. |

Sedation/analgesia is a continuum and patients may become more deeply sedated than anticipated, it is recommended that BP cuff and cardiac monitor be available even if not required.

B. **IV access.** Although not truly a monitor, an IV is also required “equipment” in all sedation/analgesia. The exceptions are children who receive *po* chloral hydrate and adults who receive *po* diazepam for sedation.

## II. The Personnel

A. General principles:

1. One **ACLS-qualified** person must be **continuously present** when sedation/analgesia is practiced. For pediatric patients, a PALS-qualified person must be present.
2. One person is **dedicated to monitoring of the patient**. This person must be trained in sedation/analgesia and must be minimum BLS-qualified.

B. Light sedation/analgesia: **two** persons are required—one MD and a **health care provider certified in sedation/analgesia** to monitor.

C. IV sedation/analgesia: **three** persons are required—one MD, one **health care provider certified in sedation/analgesia**, and one technician.

D. General anesthesia: **three** persons are required—one operator, one **credentialed anesthesia provider**, one additional person to assist.

## *Section 6*

# **Recovery Following Sedation/Analgesia**

This section briefly covers general principles for recovery following sedation/analgesia.

## **I. General Principles**

A. All patients must be recovered and monitored following sedation/analgesia until they reach a PAR score of 8 for inpatients or 10 for outpatients (or return to their baseline functional status).

B. One health care provider trained in recovery of post sedation/analgesia patients must be present in the recovery area until the patient is recovered.

C. During the recovery phase, patients will have their vital signs monitored based on established protocols.

D. All patients will have a responsible adult accompany the patient home (2 adults for pediatric patients if one adult is driving a vehicle).

## Section 7

# Documentation in Sedation/Analgesia

Unfortunately, documentation is not a very exciting topic. However, it is *very important* and your privileges to practice sedation/analgesia are dependent on your fulfilling of the documentation requirements. Below are the highlights.

The documentation in sedation/analgesia can be divided into two parts: that which you the **provider** must do and that which the **person monitoring** the patient must do.

## I. The Provider

A. For the **pre-procedure evaluation**, a **licensed independent practitioner (LIP)** with appropriate clinical privileges must **do the workup and concur** with the planned choice of sedation/analgesia. The licensed independent practitioner (for example, a surgeon or dentist) need not have privileges to actually **administer** the planned anesthesia (JCAHO standards PE-10).

B. For the purposes of the sedation/analgesia policy, a **licensed independent practitioner (LIP)** is further defined to be an attending physician/dentist or a delegated senior physician/dental resident.

C. The provider **supervising/performing** the sedation/analgesia must be **credentialed** to provide sedation/analgesia. Credentials must be requested through the Kimbrough Credentials Committee. The committee requires successful completion of the sedation/analgesia course and the approval of the provider's supervisor prior to granting privileges to practice sedation/analgesia.

D. **Pre-sedation/analgesia workup.** The LIP is responsible for the pre-sedation/analgesia workup. This includes:

1. **The history and physical exam.** Issues specific to sedation/analgesia that must be documented are **a past anesthesia history** (reactions to drugs, sensitivity to drugs) and **an airway exam**.

Example: *Pt. has a history of being very sensitive to anesthesia drugs and was admitted following a sedation in the past due to slow wake-up. Airway exam: wide mouth opening, 3 finger breadth thyro-mental distance, excellent neck range of motion.*

2. **ASA physical status assessment.** Based on the history and physical exam, the provider must do a **physical status assessment**.

This is accomplished using the American Society of Anesthesiologists (ASA) physical status classification.

## ASA Physical Status Classification

**ASA I** Healthy, no systemic disease.

**ASA II** Mild to moderate systemic disease not life-style limiting (asymptomatic hypertension, diabetes without end-organ dysfunction).

**ASA III** Severe systemic disturbance which is life-style limiting (exercise induced angina, severe asthma limiting activity, s/p CVA with weakness).

**ASA IV** Severe systemic disturbance which is life-threatening (congestive heart failure, rest angina).

**ASA V** Moribund patient with little chance of survival submitted to a procedure as a last resort.

**3. Acceptability for sedation/analgesia.** A second part of the assessment which must be documented is that the patient is **an acceptable candidate for sedation/analgesia**. In other words, following your statement of the physical status, you have determined the patient may safely have sedation/analgesia with their procedure.

*Example: The patient is a 60 year old male ASA II for hypertension. He is an acceptable candidate for sedation/analgesia with his colonoscopy.*

**4. Reassessment immediately prior to procedure.** In addition, a note must be made in the chart **on the day of the procedure** stating there has been **no change in the patient's physical status** since the history and physical was done (JCAHO requirement).

**E. Consent.** The provider supervising the sedation/analgesia must counsel the patient and document the patient's acceptance of the **risks of the sedation/analgesia** in addition to the risks of the procedure.

*Example: Risks of sedation/analgesia include but are not limited to side effects of the medications (such as nausea), allergic reactions, vomiting of stomach contents into the lungs, need for assistance with breathing, and death.*

**F. Monitoring and Recovery.** The documentation of intra-procedure monitoring and recovery is done by the health care providers assigned to monitoring the patient during the procedure and during recovery.

**G. Discharge.** Following the procedure, the provider must write a note stating that the patient had **no complications** due to the sedation/analgesia. The provider must also either write a **discharge order** or have an SOP in place detailing criteria that would allow the recovering nurse to discharge the patient once the criteria have been met.

**In summary, the provider-specific documentation includes:**

1. History to include **past anesthesia history**.
2. Physical exam to include **airway exam**.
3. **ASA Physical Status** assessment.

4. Assessment that the patient is an **acceptable candidate** for sedation/analgesia.
5. **Consent** for the sedation/analgesia, including counseling of the specific risks.
6. Immediately prior to the procedure, provider or nurse documents **no change in physical status**.
7. Statement that there were **no complications** due to sedation/analgesia.
8. **Discharge order**.

## II. The Patient Monitor

In addition, the person monitoring the patient has significant documentation responsibilities as part of the sedation/analgesia that you should be aware of.

### A. Pre-sedation/analgesia:

1. Verify and document patient identification.
2. Verify and document procedure consent form.
3. Verify *NPO* status.
4. Verify that the patient is not pregnant (when applicable).

### B. Intraprocedure monitoring:

The monitor will document vital signs **and mental status** q 5-15 min.

### C. Recovery:

1. The recovery person will complete the recovery room flow sheet which will include the PAR score on beginning and on completion of recovery.
2. Documentation that the patient received **written** post-procedure instructions.
3. The escort is present.
4. A discharge order or protocol is followed.

Although this documentation is done by the monitoring and recovery persons, **you** need to ensure your area is fulfilling these requirements.

## III. Summary

*The documentation involved in sedation/analgesia is crucial not only for patient safety but also to satisfy the requirements of credentialing organizations. If you don't do the required paperwork, you may lose your sedation/analgesia privileges.*

## Section 8

# Pediatric Sedation/Analgesia

## I. Introduction

Pediatric sedation/analgesia is a skill that is in increasing demand as more and new diagnostic and therapeutic procedures are being performed on pediatric patients. In this section we will look at the following:

- A. Differences between pediatric and adult sedation
- B. The pre-sedation workup
- C. The equipment /monitoring necessary
- D. Personnel required
- E. Recovery and discharge criteria
- F. Sedative/analgesic medications as related to pediatric sedation/analgesia.

Since we have already looked at these in reference to adult sedation/analgesia, we will concentrate on the differences in each of these areas for pediatric sedation/analgesia.

## II. Terms

**Sedation/analgesia** is the new term for “conscious sedation.” Since conscious sedation seems to be an oxymoron, the new term sedation/analgesia was coined. Sedation/analgesia can be divided into light sedation, deep sedation and general anesthesia. These terms are based on the presence or absence of airway reflexes, airway patency, and response to stimulation. The important point is that these stages are a **continuum** and one must be **prepared** in case a patient becomes more sedated than expected. In general, **children require a greater depth of anesthesia to allow a procedure to be performed.**

## III. The Differences

The child and adult are different emotionally, anatomically, and physiologically.

A. **Emotionally**, children are often less able to cooperate or tolerate painful or frightening procedures.

B. **Anatomically**, the pediatric airway has narrow nares, a large tongue (**predisposing to obstruction**); a large epiglottis, anterior glottis, slanted cords, and a narrow cricoid ring (which makes intubation different than that in an adult). Pediatric veins are obviously smaller and more difficult to cannulate. The large body surface area to mass ratio allows for greater temperature loss.

C. **Physiologically**, children have a smaller FRC, a higher metabolic rate, and a heart that depends on rate rather than contractility for cardiac output. The conclusions are that children have a **high oxygen demand** but a **smaller** margin of safety with oxygen **delivery**. Also, that heart rate **MUST** be maintained to have a sufficient cardiac output. Hypoxic children quickly become bradycardic.

**THE PEDIATRIC AIRWAY MUST BE MAINTAINED AT ALL COSTS.**

#### IV. Pre-Sedation Workup

A. The pre-sedation workup begins with consenting the parents.

B. The history and physical concentrates on the **birth history** (prematurity? intubated? bronchopulmonary dysplasia?). Those patients with a history of BPD and reactive airways are especially prone to desaturation.

C. **Airway exam.** The airway exam is extremely important. Goldenhar, Pierre-Robin, and Downs are all syndromes that involve the airway. Even if these names are not remembered, practically speaking, if the person can **open** their mouth widely, can **tilt** their head back, and has a normal **chin**, the airway should be adequate. Beware of hypoplastic mandibles.

D. **Resp/pulm history/exam.** Recent URI's are very common in pediatric patients. If the patient has a URI, most anesthesia providers would recommend postponing **ELECTIVE** sedations until two weeks after symptom resolution. Patients with URI's desaturate more quickly and are more prone to laryngospasm and bronchospasm.

E. **Cardiac exam.** A heart history and exam looking for signs or symptoms of heart defects must be done.

The rest of the history and physical is similar to the adult.

F. Another part of the preoperative workup is calculating the weight-appropriate **doses of resuscitative drugs** for each patient. Take the time to fill out the resuscitative drug sheet. It is very difficult to calculate doses "in your head" when things are going badly.

G. The last part of the pre-sedation preparation is the counseling of the parents regarding **NPO status**. The 1999 American Society of Anesthesiology Practice Guidelines for Preoperative Fasting recommends:

NPO for solids after midnight.

**Clear** liquids until 2 hours prior to the sedation.

Exceptions: patients with reflux, diabetes, or CNS dysfunction (decreased gag reflex). These patients need increased time for gastric emptying.

## V. Equipment/Monitoring

A. MEDDAC regulation 40-17 requires the following monitors (same as adults):

- |                              |   |
|------------------------------|---|
| 1. Local anesthesia only:    | Crash cart, ambu bag, mask, oxygen, suction                                     |
| 2. Light sedation/analgesia: | The above plus pulse oximeter and BP cuff.                                      |
| 3. Heavy sedation/analgesia: | The above plus cardiac monitor.   |
| 4. General Anesthesia:       | The above plus ventilator, end-tidal CO <sub>2</sub> , and temperature monitor. |

It is EXTREMELY important that you are familiar with where your equipment is and how it works. The equipment must be checked immediately prior to the sedation since some may be “borrowed” unknowingly.

B. IV access. An IV is necessary in all cases except perhaps when chloral hydrate is used. Oxygen is recommended in all cases and required if the saturation is less than 95% or signs of airway obstruction are present.

## VI. Personnel:

A. Light sedation/analgesia: **two** persons are required—one MD and a **health care provider certified in sedation/analgesia** to monitor.

B. IV sedation/analgesia: **three** persons are required—one MD, one **health care provider certified in sedation/analgesia**, and one technician.

C. One person’s main task is to monitor the patient.

D. One PALS-qualified person must be continuously present during the sedation.

## VII. Recovery

A. Discharge to home. Apply the same discharge criteria used for adults. In addition, **2 adults need to accompany the patient home**--one to drive and one to take care of the child.

B. Transport to another location. If the child needs to be transported following sedation, a transport kit must accompany the patient. Transport often occurs at the most dangerous time following sedation: the emergence. Oxygen and a method to provide positive pressure ventilation, a pulse oximeter, and a **WORKING IV** are necessary for transport. It is also recommended to have code drugs and intubation supplies immediately available.

## VIII. Common Pitfalls/Problems

A. **Bradycardia.** The first etiology in the differential diagnosis for bradycardia is always **HYPOXIA, HYPOXIA, HYPOXIA**. The first treatment should always be **OXYGEN, OXYGEN, OXYGEN** while the reason for the hypoxia is being determined.

B. **Airway obstruction by the tongue.** Children are prone to airway obstruction due to their airway anatomy. Often the diagnosis is first made by observation of a “belly rocking” motion that does not correlate with chest movement. A precipitous fall in oxygen saturation usually then occurs. **Jaw thrust and oxygen** will quickly resolve the problem if the obstruction is due to the tongue.

C. **Laryngospasm.** Another and more serious reason for obstruction is laryngospasm--spasm of the vocal cords into the closed position. Treatment is with **oxygen and gentle continuous positive pressure** via anesthesia mask. Laryngospasm can be very severe and can result in bradycardia and cardiac arrest if air exchange is not quickly resumed.

A very important point is that one should always **call for help early**--children become hypoxic and bradycardic very quickly. Oxygen is always the first treatment.

## IX. Guidelines for the Use of Sedation/Analgesia Drugs

There are 4 principles important to the use of sedative drugs.

A. An **appropriate drug** should be chosen. If the procedure will be painful (e.g., bone marrow biopsy), include an analgesic. If the procedure is non-painful (e.g., MRI), a hypnotic will be sufficient. Obviously, this entails knowing the characteristics of the different sedatives and analgesics.

B. The drug chosen must be **titrated to effect**. A practical way of performing titration is by starting with 1/2 the calculated dose, then 1/4 the dose, and finally the last 1/4 if necessary. It is important that a sufficient amount of time is waited between doses based on the known onset time of the drug.

C. Have the drugs **prepared and drawn up ahead of time**. With pediatric patients, one must be smooth and quick to prevent the patient decompensating emotionally. In other words, don't take a big syringe and needle and draw up the drug in front of the patient. It is also difficult to calculate a correct dose in front of a frightened (screaming) child.

D. **Mixing different classes of drugs increases the risk of respiratory depression.** This is especially true when combining narcotics and benzodiazepines.

## X. The Sedative/Analgesic Drugs

The following is a list of the agents and their profiles:

### A. CHLORAL HYDRATE

- Type:** sedative/hypnotic--NOT an analgesic.  
A very popular sedative.
- Use:** good for non-painful procedures in infants/small children (e.g., CT/MRI not requiring IV contrast).
- Route:** oral or rectal  
Has a very bitter taste.  
Irregular absorption for some infants.  
Minimal effect on respiration, but can depress when combined with other sedatives. IV usually not necessary.
- Onset:** delayed--can take 60+ minutes.
- Caution:** do not use if compromised hepatic or renal function.
- Side effects:** mucous membrane irritant, nausea, laryngospasm, paradoxical excitement.
- Dose:** 20-75 mg/kg PO or PR. Some use 100 mg/kg. Max dose 1500 mg.

### B. PENTOBARBITAL (NEMBUTAL)

- Type:** sedative/hypnotic, NOT an analgesic (actually hyperalgesic).
- Class:** long-acting barbiturate
- Use:** most popular for sedation for radiographic procedures.
- Route:** PO, PR, IM, IV.  
IM injection is painful (very alkylotic).
- Onset:** quick when given IV.
- Caution:** When combined with narcotics, markedly increased risk of airway obstruction/hypoventilation.  
Contraindicated in porphyria.
- Side effects:** hypersensitivity reaction, hypoventilation, apnea.
- Dose:** 5 mg/kg IM or 1-2 mg/kg IV. Max dose 5 mg/kg or 100 mg IV.

### C. FENTANYL (SUBLIMAZE)

- Type:** sedative AND analgesic
- Class:** narcotic, 75-125 times more potent than morphine.
- Use:** for painful procedures.
- Onset:** 1-2 min.
- Duration:** high degree of fat solubility. Has rapid onset of action. Shorter duration than morphine--due to redistribution to inactive sites. Opioid effects last 30-45 minutes.
- Caution:** causes RESPIRATORY DEPRESSION, especially when given with other sedatives.
- Side effects:** RESPIRATORY DEPRESSION, chest wall rigidity, nausea/vomiting.
- Dose:** 0.5-1.0 micrograms/kg IV--give slowly over 3-5 min.m  
max dose: 3-4 micrograms/kg.

## D. MIDAZOLAM (VERSED)

**Type:** sedative/hypnotic--not an analgesic  
provides anterograde and retrograde amnesia  
**Class:** benzodiazepine  
**Route:** PO, PR, IM, IN, IV.  
**Duration:** short half-life (100 min)  
**Side effects:** respiratory depression (increased with narcotics), hypotension.  
**Dose:**  
PO/PR 0.5-0.75 mg/kg  
IM 0.08-0.1 mg/kg  
IV 0.05-0.1 mg/kg

## E. MORPHINE

**Type:** sedative and analgesic  
used for comparison to all other narcotics  
**Use:** for painful procedures.  
**Route:** usually IV or IM.  
**Duration:** long-acting (3-4 hours)  
**Side effects:** respiratory depression, constipation, hypotension, bradycardia, allergic reaction, itching, nausea.  
**Dose:** IM 0.1-0.2 mg/kg  
IV 0.05-0.2 mg/kg

## F. MEPERIDINE (DEMEROL)

**Type:** sedative and analgesic  
**Class:** narcotic  
1/10 as potent as morphine.  
Has more side effects and drug-drug interactions.  
**Use:** for painful procedures.  
**Route:** IM, IV  
**Duration:** peak analgesia may occur after procedure is completed.  
**Side effects:** respiratory depression, nausea, smooth muscle spasm, constipation.  
**CONTRAINDICATIONS:** monoamine oxidase inhibitors (MAO), cardiac arrhythmias, asthma, increased ICP.  
**Dose:** 1-2 mg/kg (max 100 mg.)

## G. KETAMINE (KETALAR)

**Type:** hypnotic, analgesic, amnestic  
**Use:** dissociative agent, provides intense analgesia, hypnosis, and amnesia.  
**Onset:** fast onset within 30 secs (IV), within 2-4 min (IM).  
**Duration:** 5-15 min (IV), 12-25 min (IM).  
**Advantages:** maintains skeletal muscle tone and therefore helps maintain airway patency; intense analgesia.  
**Disadvantages:** hypersalivation (still prone to laryngospasm), stimulates sympathetic nervous system, hypertonus and random muscle movements.  
**Side effects:** stridor, laryngospasm, emergence reaction, respiratory depression, diplopia, increased ICP and IOP.  
**Dose:** IM 2-5 mg/kg. IV 0.25-0.5 mg/kg doses titrated to effect

## H. Local anesthetics

1. EMLA cream

Combination of lidocaine and prilocaine

Apply to skin for 30-60 minutes with occlusive dressing.

Use: Skin anesthesia for IV starts, LP's, venipuncture, laser therapy.

Side effects: Methemoglobinemia; toxic if swallowed.

2. Lidocaine: short acting (90 min)

max dose 7 mg/kg with epinephrine

3. Bupivacaine: long acting (180 min)

max dose 2.5 mg/kg with epinephrine

**Toxicity** symptoms and signs:

1. Neurologic (mental status changes, symptoms of ringing in ears, metallic taste in mouth, vague feeling of unease)

2. Cardiac (arrhythmias, hypotension)

**Toxicity is a function of site, rate of uptake, and alteration of toxic threshold.**

## XI. Summary

Administration of pediatric sedation/analgesia is a difficult skill that involves maintenance of the airway, selection of an appropriate/sedative analgesic for the procedure, and the careful titration of the medications. Knowledge and skills are also necessary to treat the side effects and complications of pediatric sedation/analgesia.

# ***Sedation/Analgesia Provider Course Test***

Complete the enclosed test and return **both** the answer sheet and the enclosed Request for Sedation/Analgesia Privileges to:

**CDR USAMEDDAC  
ATTN MCXR NS ANE LTC ALBEE  
2480 LLEWELLYN AVE  
FORT MEADE MD 20755-5800**

**Be sure that both you and your supervisor sign the Request for Privileges Form prior to returning it.** You will be notified by the credentials committee when you have been granted sedation/analgesia privileges.

Thank you for completing the Sedation/Analgesia Provider Course. We hope it will be helpful to your practice.

## Sedation/Analgesia Course Test

Type K

- A. Options 1, 2, and 3
  - B. Options 1, 3
  - C. Options 2, 4
  - D. Option 4 ONLY
  - E. Options 1, 2, 3, and 4
1. Light sedation/analgesia means
    1. Consciousness is minimally depressed.
    2. The patient is unable to respond to verbal commands.
    3. The patient maintains a patent airway.
    4. The patient does not respond to physical stimuli.
  2. The terms light sedation/analgesia, heavy sed/anal, and general anesthesia
    1. Refer to different levels of sedation based on level of consciousness, ability to maintain a patent airway, and presence of airway reflexes.
    2. Describe different levels of sedation that are actually part of a continuum of sedation that can change quickly during the course of a sedation.
    3. Are levels of sedation that require different levels of monitoring.
    4. Are clearly defined levels of sedation that never change throughout the sedation.
  3. Which of the following definitions are correct?
    1. Analgesia means the patient does not feel pain during the procedure.
    2. Amnesia means the patient does not recall the procedure.
    3. Hypnosis means the patient has a decreased level of consciousness during the procedure.
    4. Amnesia means the patient does not feel pain during the procedure.
  4. Preoperative evaluation of a patient's medical history includes determining
    1. Medications the patient takes.
    2. Allergies to medications.
    3. Reaction to sedative/analgesic medications in the past.
    4. Whether the patient is pregnant.
  5. Prior to performing sedation/analgesia, the following must be accomplished:
    1. Consent for sedation/analgesia, including documentation of specific risks.
    2. Note by provider stating the patient is an acceptable candidate for sedation/analgesia.
    3. Pre-operative evaluation including airway exam and ASA physical status.
    4. A note immediately pre-procedure stating "no change in physical status."

## Sedation/Analgesia Course Test

### Type K

- A. Options 1, 2, and 3
  - B. Options 1, 3
  - C. Options 2, 4
  - D. Option 4 ONLY
  - E. Options 1, 2, 3, and 4
6. For outpatients undergoing sedation/analgesia,
- 1. The patient must receive written pre-procedure instructions.
  - 2. The patient must have an escort to take them home.
  - 3. Adults must be NPO after midnight.
  - 4. Children must be NPO after midnight.
7. Indications of an airway that would be easy to manage (mask ventilate or intubate) include:
- 1. The ability to open the mouth widely.
  - 2. A recessed (small) mandible.
  - 3. Full range of motion in the neck.
  - 4. A history that the patient snores violently when sleeping.
8. The following patients would be safe to routinely sedate without other assistance:
- 1. A 24 year old female for a head CT that is in a halo because of a broken neck.
  - 2. A 62 year old female for colonoscopy with diet-controlled diabetes and a normal airway.
  - 3. A 4 year old boy with a large neck mass for a bone marrow biopsy.
  - 4. A 10 year old boy for MRI with mental retardation.
9. A 24 year-old male with asthma
- 1. Would be considered ASA II if his asthma is usually asymptomatic, he rarely takes MDI's, and it does not limit his usual activities.
  - 2. Would be considered ASA III if it limited his activities and required daily nebs to control.
  - 3. Would be considered ASA IV if he was intubated in status asthmaticus.
  - 4. Would be considered ASA I if he took nebs only 4-5 times per week.
10. If a patient has a difficult airway,
- 1. Do not sedate if not necessary.
  - 2. Sedate lightly if sedation/analgesia is required.
  - 3. If unable to do with light sedation, schedule anesthesia assistance.
  - 4. Sedate heavily and hope for the best.

## Sedation/Analgesia Course Test

### Type K

- A. Options 1, 2, and 3
  - B. Options 1, 3
  - C. Options 2, 4
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11. True statements regarding pulmonary assessment include
- 1. If the patient has a URI, wait 2 weeks until after symptoms have resolved, if possible.
  - 2. Obtain a baseline saturation prior to beginning sedation/analgesia.
  - 3. If the patient has a pneumonia, wait 4 weeks until after symptoms have resolved, if possible.
  - 4. Sedating a patient with significant respiratory compromise will usually improve the oxygen saturation.
12. The following patients are at increased risk of aspiration during sedation/analgesia
- 1. A patient that report she sleeps on 3 pillows at night to avoid reflux or regurgitation.
  - 2. A 25 year old male that is 59 inches tall and weighs 137 KG.
  - 3. A 42 year old patient with severe/long-standing diabetes.
  - 4. A woman who is 36 weeks pregnant.
13. The NPO guidelines for children are
- 1. No solids after midnight.
  - 2. Solids allowed until 2 hours prior to the procedure.
  - 3. Clear liquids until 2-3 hours prior to the procedure.
  - 4. Clear liquids until 1 hour prior to the procedure.
14. Pre-procedure laboratory studies that are recommended include:
- 1. Children: none.
  - 2. Females < 40 years: HCG (pregnancy test) if applicable.
  - 3. Females < 40 years: HCT (if the pt. has not had a hysterectomy).
  - 4. Males and females age 40-59 years: EKG, BUN, HCT, Glucose, CXR.
15. The desired endpoint for sedation/analgesia is
- 1. A cooperative, comfortable patient.
  - 2. A patient with a respiratory rate of 6 that only grunts in response to a sternal rub.
  - 3. A patient with slightly slurred speech and respiratory rate of 15/min.
  - 4. A disinhibited patient that won't hold still.

## Sedation/Analgesia Course Test

Type K

- A. Options 1, 2, and 3
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16. The following medications are excellent analgesics:
- 1. Midazolam (VERSED)
  - 2. Fentanyl (SUBLIMAZE)
  - 3. Sodium thiopental (PENTOTHAL)
  - 4. Ketamine (KETALAR)
17. Midazolam (VERSED)
- 1. Is longer-acting than Diazepam (VALIUM).
  - 2. Will not cause respiratory depression.
  - 3. Provides excellent analgesia and is an excellent drug for painful procedures.
  - 4. Provides amnesia.
18. When dosing midazolam (VERSED), the best approach is
- 1. Calculate 0.1 mg/kg and give as a bolus IV push.
  - 2. In adults, titrate by giving 1 mg IV every few minutes until the patient experiences anxiolysis and slightly slurred speech.
  - 3. Give geriatric patients twice the usual starting dose.
  - 4. In adults, titrate beginning with 0.5 mg IV in those patients with renal failure.
19. General principles regarding fentanyl and its dosing include:
- 1. A reasonable dosing approach is to give a rapid 3 microgram/kg bolus IV.
  - 2. Watch out for respiratory depression, especially if combining with benzodiazepines.
  - 3. Fentanyl is an excellent amnestic.
  - 4. In adults, titrate 50 micrograms (1cc) IV every few minutes until the patient becomes sleepy but remains easily arousable to voice.
20. Which of the following drugs can depress ventilation?
- 1. Ketamine
  - 2. Midazolam
  - 3. Fentanyl
  - 4. Morphine

## Sedation/Analgesia Course Test

### Type K

- A. Options 1, 2, and 3
  - B. Options 1, 3
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21. Regarding the narcotics commonly used for sedation/analgesia,
- 1. Fentanyl is 100 times as potent as meperidine (Demerol).
  - 2. Fentanyl is 100 times as potent as morphine.
  - 3. These narcotics do not cause respiratory depression.
  - 4. Meperidine is 1/10 the potency of morphine.
22. Narcotics such as fentanyl, meperidine, and morphine can
- 1. Cause respiratory depression.
  - 2. Be reversed with Flumazenil (Romazicon).
  - 3. Cause chest rigidity.
  - 4. Prevent nausea.
23. A 65 year-old male receives fentanyl for a colonoscopy. On completion of the procedure, the scope is removed and the patient becomes more difficult to arouse. He barely grunts a response after repeated, loud questioning. Respiratory rate is 6/min, saturation is 100% on 3 l NC O2; BP and pulse are normal. A reasonable approach would be:
- 1. Dilute one 0.4 mg/cc amp (1cc) of narcan into 9cc normal saline (final conc 40 micrograms/cc) and titrate 1cc (40 micrograms) every 1-2 minutes until sedation reverses.
  - 2. Push one amp of narcan (0.4 mg/cc) undiluted stat.
  - 3. Monitor the patient for 2 hours after the narcan is given to ensure he does not "re-narcotize."
  - 4. Intubate the patient immediately, then push reversal.
24. True statements regarding reversal of benzodiazepines with flumazenil include:
- 1. Flumazenil (0.1 mg/cc) does not need to be diluted prior to use.
  - 2. Flumazenil may be titrated 0.2 mg (2cc) IV every 1-2 minutes until reversal occurs.
  - 3. Maximum single dose is 1 mg.
  - 4. Patients must be monitored for 2 hours following flumazenil administration.
25. True statements regarding the anatomy and physiology of the child include:
- 1. The child's airway is more likely to obstruct than an adult's airway.
  - 2. The child has a larger functional residual capacity (respiratory reserve) than the adult.
  - 3. The child has a higher metabolic rate (per kg) than the adult.
  - 4. The child desaturates more slowly than the adult when airway obstruction occurs.

## Sedation/Analgesia Course Test

Type K

- A. Options 1, 2, and 3
- B. Options 1, 3
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26. Ketamine

- 1. causes the patient to salivate, sometimes profusely.
- 2. has a quick onset and short duration when used in the usual clinical doses.
- 3. is an excellent amnestic.
- 4. is an excellent analgesic.

You are sedating a 3 year old boy for an MRI scan of the head. He has started to snore, with the snoring becoming louder. You then notice that his stomach and chest are rocking in a jerky sort of fashion and his snoring has stopped. Quickly the pulse oximeter drops into the 80's and continues to drop.

27. You immediately:

- 1. Intubate the patient and call a code.
- 2. Provide gentle jaw thrust and head tilt and quickly re-evaluate to see whether the patient is ventilating.
- 3. Give an albuterol nebulizer.
- 4. Apply face mask oxygen.

28. The above patient most likely

- 1. Is having laryngospasm.
- 2. Is having bronchospasm.
- 3. Has aspirated stomach contents.
- 4. Has his airway obstructed by his tongue.

29. Important principles in pediatric sedation/analgesia are:

- 1. Maintain the airway at all costs.
- 2. The most common cause of bradycardia is hypoxia.
- 3. Prevent bradycardia and immediately treat it if it occurs.
- 4. Tachycardia is not well tolerated in children.

## Sedation/Analgesia Course Test

Type K

- A. Options 1, 2, and 3
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30. Important principles in the administration of sedative/analgesics include:

- 1. Always bolus drugs quickly.
- 2. Combining different types of drugs decreases the risk of respiratory depression.
- 3. Use only a hypnotic drug for painful procedures.
- 4. Use a drug with analgesic properties for painful procedures.

31. The following medications should NOT be used for sedation/analgesia outside of the operating room:

- 1. Sufentanil
- 2. Propofol
- 3. sodium thiopental
- 4. succinylcholine

32. General principles for personnel required for sedation/analgesia include:

- 1. One ACLS (or PALS as age-appropriate) qualified person must be continuously present during sedation analgesia.
- 2. One person's only duty must be to monitor the patient.
- 3. The provider directing/supervising IV sedation/analgesia must be credentialed to do so.
- 4. Provider credentialing for sedation/analgesia is through the credentials committee. The committee requires successful completion of the sedation/analgesia course and approval of the appropriate supervisor.

33. True statements regarding intra-procedure monitoring and documentation include:

- 1. The person dedicated to monitoring will document vital signs q 5-15 min depending on type of sedation/analgesia (light vs. deep).
- 2. The patient's level of sedation must be continuously monitored and documented q 15 min.
- 3. For light sedation/analgesia, 2 people are required--the operator/sedation supervisor and the person monitoring the patient.
- 4. For heavy sedation/analgesia, only 2 people are required--the operator/sedation supervisor and the person monitoring the patient.

34. Minimum equipment/monitors for light sedation/analgesia include:

- 1. Crash cart available.
- 2. Oxygen/suction available.
- 3. Ambu bag and mask (method to provide positive pressure ventilation).
- 4. Pulse oximeter.

## Sedation/Analgesia Course Test

Type K

- A. Options 1, 2, and 3
- B. Options 1, 3
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35. Prior to discharge, the physician/dentist must
1. Document there were no apparent complications due to the sedation/analgesia.
  2. Write a discharge order or have an approved discharge protocol in place.
  3. Ensure the patient has written discharge instructions.
  4. Ensure the patient has an escort to take the patient home.

### **True or False:**

36. Physicians must state in their pre-procedure evaluation that the patient is an acceptable candidate for sedation/analgesia.
37. Physicians must state in their pre-procedure work-up the patient's ASA physical status classification.
38. When consenting the patient for the procedure, the provider does not need to consent the patient for sedation and analgesia.
39. When consenting the patient for sedation/analgesia, the provider does not need to list the specific risks of sedation/analgesia.
40. Immediately prior to sedation/analgesia, the physician must document that there has been no change in the patient's physical status (condition).

## Sedation/Analgesia Provider Course Test Answer Sheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Duty Station/Clinic: \_\_\_\_\_

Pager number: \_\_\_\_\_

Write your answer next to the appropriate number.

- |           |           |           |
|-----------|-----------|-----------|
| 1. _____  | 16. _____ | 31. _____ |
| 2. _____  | 17. _____ | 32. _____ |
| 3. _____  | 18. _____ | 33. _____ |
| 4. _____  | 19. _____ | 34. _____ |
| 5. _____  | 20. _____ | 35. _____ |
| 6. _____  | 21. _____ | 36. _____ |
| 7. _____  | 22. _____ | 37. _____ |
| 8. _____  | 23. _____ | 38. _____ |
| 9. _____  | 24. _____ | 39. _____ |
| 10. _____ | 25. _____ | 40. _____ |
| 11. _____ | 26. _____ |           |
| 12. _____ | 27. _____ |           |
| 13. _____ | 28. _____ |           |
| 14. _____ | 29. _____ |           |
| 15. _____ | 30. _____ |           |

**RETURN THE ANSWER SHEET AND THE REQUEST FOR PRIVILEGES TO:**

**CDR USAMEDDAC  
ATTN MCXR NS ANE LTC ALBEE  
2480 LLEWELLYN AVE  
FORT MEADE MD 20755-5800**

## Request for Sedation/Analgesia Privileges

Name: \_\_\_\_\_

Department: \_\_\_\_\_

Pager: \_\_\_\_\_

Score: \_\_\_\_\_ Pass: \_\_\_\_\_ Fail: \_\_\_\_\_

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Upon successful completion of the Sedation/Analgesia examination, I hereby request privileges to perform Sedation/Analgesia.

\_\_\_\_\_  
DATE

\_\_\_\_\_  
PROVIDER SIGNATURE

I recommend approval that the above named provider be granted privileges to perform Sedation/Analgesia.

\_\_\_\_\_  
DATE

\_\_\_\_\_  
DEPT/SVC CHIEF SIGNATURE